

1 Introduction

- Arctic storm activities have shown intensification during recent decades, which may have contributed to or caused extreme climate events.
- We examined Arctic storm activities in 10 ensemble simulations by using the Arctic regional coupled climate model HIRHAM-NAOSIM.
- Storm identification and tracking algorithm (Zhang et al., 2004) were employed to derive intensity, location and duration of each storm.
- Arctic regional storm climatology and variability were constructed and compared with the same statistics derived from the ERA-interim reanalysis data.

2 Model and Model Output Data

Arctic regional coupled climate model HIRHAM-NAOSIM

- Model domain: Arctic
- Resolution: 0.5 degree (~50 km)
- Simulation period: 1979 to 2014
- Atmospheric initial condition and lateral boundary condition: ERA-interim reanalysis
- Ocean and sea ice initial condition: from two previous 1948-2008 HIRHAM-NAOSIM simulations (runA and F) (Table 1 in Dorn et al., 2012)
- Model's output data to use: 6 hourly mean sea level pressure (MSLP)

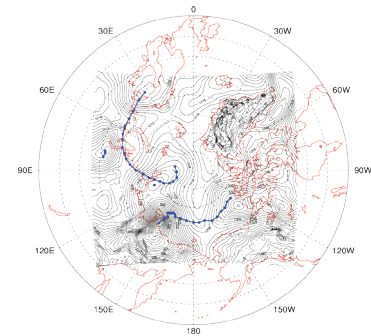


Fig. 1: A simulated storm process from 1800UTC 4 August to 0000UTC 10 August 2012, which moves from 71.6°N, 142.4°E to 77.5°N, 128.3°W was depicted (blue lines). Each blue dot represents the storm center at each time step. The black lines are the mean sea level pressure (hPa) contours at 1800 UTC 4 August 2012.

3 Comparison with ERA reanalysis data

- The mean sea level pressure (MSLP) from 10 ensemble simulations shows good agreement with reanalysis data (ERA-interim).
- The ensemble simulations overestimate the high pressure over Greenland in summer and underestimate the high pressure over East Siberian Sea and Beaufort Sea in winter.

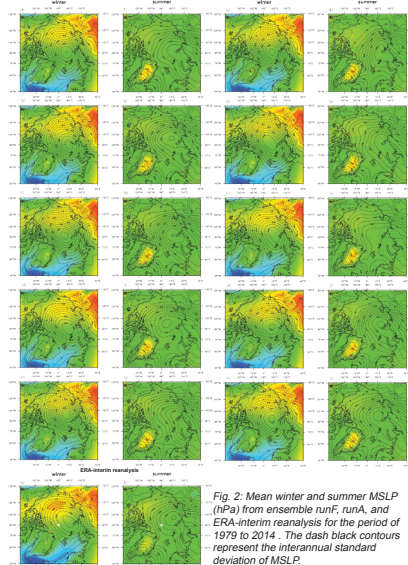


Fig. 2: Mean winter and summer MSLP (hPa) from ensemble runF, runA, and ERA-interim reanalysis for the period of 1979 to 2014. The dash black contours represent the interannual standard deviation of MSLP.

4 Storm Count Spatial Distribution

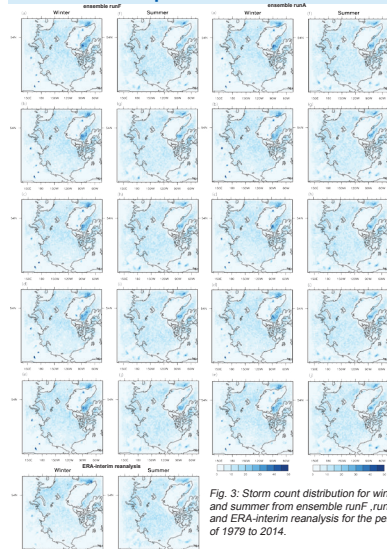


Fig. 3: Storm count distribution for winter and summer from ensemble runF, runA, and ERA-interim reanalysis for the period of 1979 to 2014.

5 Climatology of Storm Activity

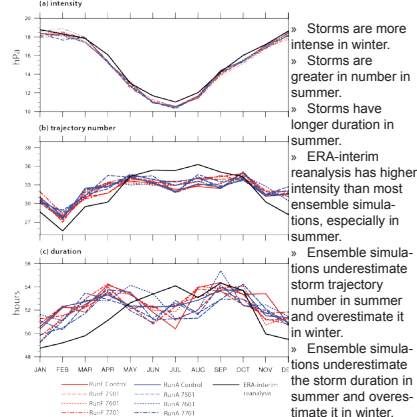


Fig. 4: Mean seasonal cycle of storm (a) intensity, (b) trajectory number, and (c) duration in the model domain from 1979 to 2014.

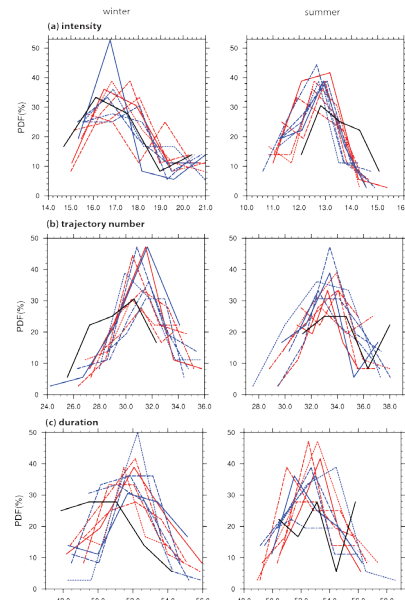


Fig. 5: Probability distribution function of storm (a) intensity (b) trajectory number, and (c) duration for winter and summer for the period of 1979 to 2014. The black lines represent the result from ERA-interim reanalysis. The red and blue lines represent the result from each ensemble member.

6 Interannual Variability of Storm Activity

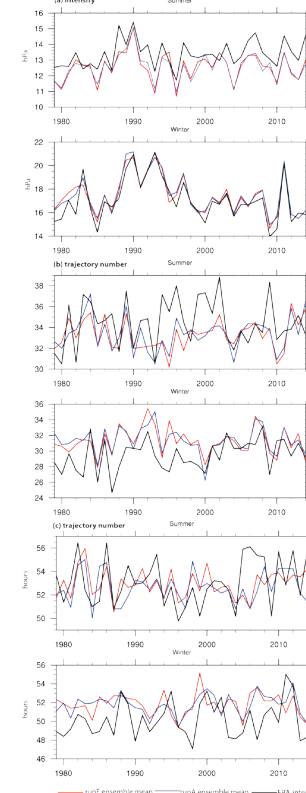


Fig. 6: Interannual variability of storm (a) intensity, (b) trajectory number, and (c) duration for the period of 1979 to 2014 for winter and summer. Red lines represent the ensemble mean value of runF, and blue lines represent the ensemble mean value of runA. Black lines are for ERA-interim reanalysis.

7 Summary and future work

- The climatological seasonal cycle from all ensemble simulations demonstrates a stronger intensity in winter and a weaker intensity in summer, consistent with what was revealed by previous studies using global reanalysis.
- The storm trajectory number are very similar between regional model HIRHAM-NAOSIM and ERA-interim.
- Impacts of underlying sea ice and ocean properties, which were perturbed initially for the ensemble simulation will be examined in order to understand the across-ensemble spread.
- Physical mechanisms responsible for the interannual variability will also be investigated.